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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/146,839	09/03/1998	ANAND SRINIVASAN	MI22-1017	9907

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WELLS ST. JOHN ROBERTS GREGORY & MATKIN P.S.
601 W. FIRST AVENUE
SUITE 1300
SPOKANE, WA 99201-3828

EXAMINER

MAI, ANH D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 03/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/146,839

Applicant(s)

SRINIVASAN ET AL.

Examiner

Anh D. Mai

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- The MAILING DATE of this communication appears on the cover sheet with the correspondence address -

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 February 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 4-8, 10, 13-19, 22-28, 36, 38, 39 and 43-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 4-8, 10, 13-19, 22-28, 36, 38, 39 and 43-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's previous and current submission filed on December 16, 2002 and February 14, 2003, respectively, have been entered.

Amendment

2. Amendment filed December 16, 2002 and February 14, 2003 have been entered as Paper No. 28 and 32, respectively. Claims 18, 38 and 43 have been amended. Claims 47-52 have been newly added. Claims 1, 4-8, 10, 13-19, 22-28, 36, 38, 39 and 43-52 are pending.

Claim Objections

3. Claims 38, 39, 43 and 44 are objected to because of the following informalities:

Claims 38 and 43 appear to claimed a same matter (500 °C to 700°C), and claims 39 and 44 appear to claimed a same matter (600 Torr).

Appropriate correction is required.

Response to Amendment

4. The amendment filed December 16, 2002 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not

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supported by the original disclosure is as follows: “maintaining a temperature within the reaction chamber in excess of (or from about) 500 °C but less than 700 °C during the depositing” and “pressure from about 400 to about 700 Torr”.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 38 and 43 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There does not appear to be a written description of the claim limitation “maintaining a temperature within the reaction chamber in excess of (or from about) 500 °C but less than 700 °C during the depositing” and “pressure from about 400 to about 700 Torr” in the application as filed.

At best, the specification discloses: “preferably maintained at from about 400 °C to about 700 °C, and more preferably maintained at about 500 °C” and “preferably at from about 400 Torr to about 1 atmosphere” (or 760 Torr). (See page 5, lines 3-12).

Note that 500 °C is a specific number and does not contain a range (500-700 °C) and 700 Torr does not have support from the specification.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 45-48 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Vassiliev (U.S. Patent No. 5,876,798) (cited previously).

With respect to claim 45, Vassiliev teaches a method of forming an insulating material as claimed including:

providing a substrate (3) within a reaction chamber;

providing reactants comprising silicon, fluorine and ozone within the reaction chamber and maintaining a pressure within the reaction chamber of from about 10 Torr to about 760 Torr (1 atmosphere); and

with a plasma present in the reaction chamber, depositing an insulating material, comprising fluorine, silicon and oxygen onto the substrate from the reactants. (See col. 1-6).

With respect to claim 46, Vassiliev teaches a method of forming a silicon oxide having Si-F bonds as claimed including:

providing a substrate (3) within a reaction chamber;

providing reactants comprising ozone and a precursor having Si-F bonds and maintaining a pressure of from about 10 Torr to about 760 Torr (1 atmosphere); and

with a plasma present in the reaction chamber, depositing a silicon oxide having Si-F bonds onto the substrate from the reactants. (See col. 1-6).

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With respect to claims 47 and 48, as best understood by the examiner, the pressure of Vassiliev (10 - 760 Torr) includes the claimed range.

7. Claims 49-52 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Maeda et al. (U.S. Patent No. 5,800,877) (cited previously).

With respect to claim 49, Maeda teaches a method of forming an insulating material as claimed including:

providing a substrate (6) within a reaction chamber (1);

providing reactants comprising silicon, fluorine and ozone within the reaction chamber;

and

depositing an insulating material comprising fluorine, silicon and oxygen onto the substrate from the reactants, the depositing occurring at a rate of from about 1000 to about 10000 Å/min. (See col. 1-8).

With respect to claim 50, the depositing of Maeda is occurred with a plasma present in the reaction chamber (1).

With respect to claim 51, Maeda teaches a method of forming an insulating material as claimed including:

providing a substrate (6) within a reaction chamber (1);

providing reactants comprising ozone and a precursor having Si-F bonds; and

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depositing a silicon oxide having Si-F bonds onto the substrate from the reactants, the depositing occurring at a rate of from about 1000 to about 10000 Å/min. (See col. 1-8).

With respect to claim 52, the depositing of Maeda is occurred with a plasma present in the reaction chamber.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claims 1, 4-7, 10, 16-19, 36, 38, 39, 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vassiliev '798.

With respect to claim 1, Vassiliev teaches a method of forming a fluorine doped insulating material substantially as claimed including:

providing a substrate (3) within a reaction chamber, the reaction chamber controlled within a range of temperatures above 400 °C but not greater than about 700 °C;

providing reactants comprising silicon, fluorine and ozone within the reaction chamber and maintaining a pressure within the reaction chamber of from about 10 Torr to about 760 Torr (1 atmosphere); and

depositing an insulating material, comprising fluorine, silicon and oxygen onto the substrate from the reactants, wherein the depositing occurs with a plasma being present in the reaction chamber.

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Note that the fluorine doped insulating layer of Vassiliev having a thickness of about 1,000 to 20,000 Å.

Regarding the deposition rate, it is well known in the art that the deposition rate is readily determined by the input of the reactant gases. The depositing rate does not appear to be critical.

Given the teaching of the reference, it would have been obvious to one having ordinary skill in the art at the time of invention to determine the optimum deposition rate of the fluorine doped insulating material. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

With respect to claims 4-6, the reactants of Vassiliev comprises silicon and fluorine within a common molecule (FTES).

With respect to claim 7, the fluorine in the insulating material of Vassiliev is present in Si-F bonds.

With respect to claim 10, the claimed pressure (600 Torr) is within the pressure range taught by Vassiliev.

With respect to claims 16 and 17, the reactants of Vassiliev comprise a molecule that includes both Si and F (FTES), and another molecule that includes Si without F (TEOS).

With respect to claim 36, the deposition rate has been discussed above.

With respect to claim 18, Vassiliev teaches a method of forming a silicon oxide having Si-F bonds substantially as claimed including:

providing a reaction chamber at a temperature in excess of 400 °C but less than 700 °C;

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positioning a substrate (3) within the reaction chamber;

providing an ozone comprising reactant and a precursor having Si-F bonds to the substrate within the reaction chamber and maintaining a pressure within the reaction chamber of from about 10 Torr to about 760 Torr (1 atmosphere);

while providing the ozone comprising reactant and the precursor having Si-F bonds to the substrate, providing a plasma within the reaction chamber; and

causing a silicon oxide having Si-F bonds, to deposit onto the substrate within the reaction chamber. (See col. 1-6).

Note that the silicon oxide layer having Si-F bonds of Vassiliev having a thickness of about 1,000 to 20,000 Å.

Regarding the deposition rate, it is well known in the art that the deposition rate is readily determined by the input of the reactant gases. The depositing rate does not appear to be critical.

Given the teaching of the reference, it would have been obvious to one having ordinary skill in the art at the time of invention to determine the optimum deposition rate of the fluorine doped insulating material. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

With respect to claim 19, the precursor having Si-F bonds of Vassiliev is FTES.

With respect to claims 38 and 43, as best understood by the examiner, the reaction chamber of Vassiliev is maintained at a temperature that overlaps the claimed range.

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Vassiliev further teaches the reaction chamber can be heated to a temperature of 500 °C or more. Additionally, the claimed temperature range does not appear to be critical.

Given the teaching of the references, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to determine the optimum temperature of the deposition chamber. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

With respect to claims 39 and 44, as best understood by the examiner, the reaction chamber of Vassiliev is maintained at a pressure that includes the claimed range.

9. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Vassiliev '798, as applied to claim 1 above, and further in view of Homma (U.S. Patent No. 5,288,518) (cited previously).

Vassiliev teaches all of the features of the claim with the exception of disclosing the atomic percentage of fluorine in the insulating material.

However, Homma '518 teaches the atomic percentage of fluorine in the fluorine doped insulating material is within the claimed range.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to form fluorine doped insulating material of Vassiliev having the atomic percentage of fluorine as taught by Homma to achieve a low dielectric constant.

Further, no criticality has been established.

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Given the teaching of the reference, it would have been obvious to one having ordinary skill in the art at the time of invention to determine the optimum atomic percentage of fluorine in the fluorine doped insulating material. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation."

10. Claims 13-15 and 22-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vassiliev '798 as applied to claims 1 above, and further in view of Kirchhoff et al. (U.S. Patent No. 6,057,250) (cited previously).

With respect to claims 13-15, 23 and 25, Vassiliev teaches all of the features of the claim with the exception of further includes boron and phosphorous in the reactant gases.

However, Kirchhoff teaches forming fluorine doped insulating material further includes boron and phosphorous.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention was made to include boron and phosphorous in the fluorine doped insulating material of Vassiliev as taught by Kirchhoff to lower the reflow temperature.

With respect to claims 22 and 26, the boron-containing precursor of Kirchhoff is TEB.

With respect to claims 24 and 27, the phosphorous-containing precursor of Kirchhoff is TEPO.

With respect to claim 28, the phosphorous-containing precursor and boron-containing precursor of Kirchhoff is TEPO and TEB.

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Response to Arguments

11. Applicant's arguments filed June 25, 2002 have been fully considered but they are not persuasive.

With respect to the effectiveness of the Declaration, Applicants traverse and request reconsideration.

However, Applicants fail to clearly specify the ground of traversal.

As clearly indicated in the Advisory action, the Declaration clearly lacks the details of the claimed invention, namely: temperature, pressure, ambient and deposition rate.

Note that, the elements as shown in the Invention Disclosure, have been claimed by the reference (Vassiliev).

The Declaration has been entered as Paper No. 26, and considered. However, the Declaration is ineffective.

With respect to Vassiliev, Applicants contend that "Vassiliev does not provide any mention of the processing condition used to produce the subject matter of Fig. 2 *except to say that it was deposited using plasma enhanced CVD...* , however, each of the three embodiments expressly does not include the use of plasma".

Note that, one having ordinary skill in the art should have recognized that, the deposition of Vassiliev does include plasma and PECVD clearly disclosed and acknowledged.

Regarding plasma, the present invention, however, only disclose plasma as an after thought "Most preferably, **no plasma** is present within the CVD reaction chamber *to reduce*

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costs and process complexity. However, it is noted that the invention encompasses embodiments wherein plasma is present within the reaction chamber during the deposition process”.

The disclosure does not even mention what kind of plasma is involved.

Further note that, Applicant’s citation “plasma enhanced deposition must not be incorporate” is taken completely out of the context.

A complete sentence is “the method such as plasma enhanced deposition must not be incorporated even though **they may offer some short term advantages such as high deposition rates**”.

Which means, one advantage of the PECVD is high deposition rates, however, it is not practical for used to fill the grooves since the voids will form. On the other hands, if the fluorine containing insulation layer was to form on a flat surface, then PECVD is an obvious choice for it high deposition rates.

Applicant’s conclusion “Accordingly, Applicant assert that Vassiliev does not disclose the claim 45 and 46 maintaining of pressure from about 400 to 760 Torr and depositing with a plasma present in the reaction chamber” is purely a conjecture since Applicant have already “acknowledged that the three embodiments of Vassiliev described in column 5 suggest 10-760 Torr may be acceptable”.

Further note that, the Declaration filed previously is ineffective and did not establish conception of the claims 45 and 46 prior to Vassiliev’s.

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Applicant asserts: “the most can be said of Vassiliev is that it might suggest such pressure limitation”. The acknowledgement of “Vassiliev might suggest such pressure limitation” is more than enough to anticipate the claimed invention.

The C.F.R. 1.131 requires (b) the showing of facts shall be such, in character and weight, as to establish reduction to practice prior to the effective date of the reference, or conception of the invention...

The facts, e.g. temperature, pressure, ambient and deposition rate, etc., are clearly absent from the Declaration.

Finally, Applicants’ arguments, with respect to all claims, rely on the effectiveness of the Declaration. Since it is determined that the Declaration is ineffective to overcome the reference, Vassiliev, the arguments with respect to all claims are moot.

Conclusion

12. This is a continuation of applicant's earlier Application No. 09/146,839. All claims are drawn to the same invention claimed in the earlier application and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the earlier application. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action in this case. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after

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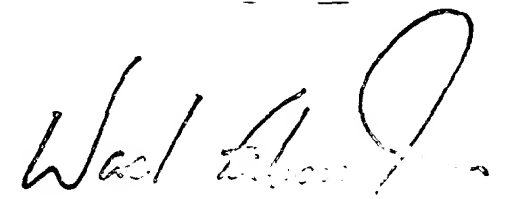
the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
March 18, 2003


SUPERVISOR
TECHNOLOGY CENTER 2000